

# Overset Applications at NASA JSC

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## Presentation Outline

### Recent applications

- X-38
  - “As-built” geometry – V131R analysis
  - High-fidelity geometry – Model G analysis
  - Aero-heating
- Aerodynamic Research Facility (ARF)  
Wind Tunnel Simulations
  - Separation aerodynamics

### Future plans



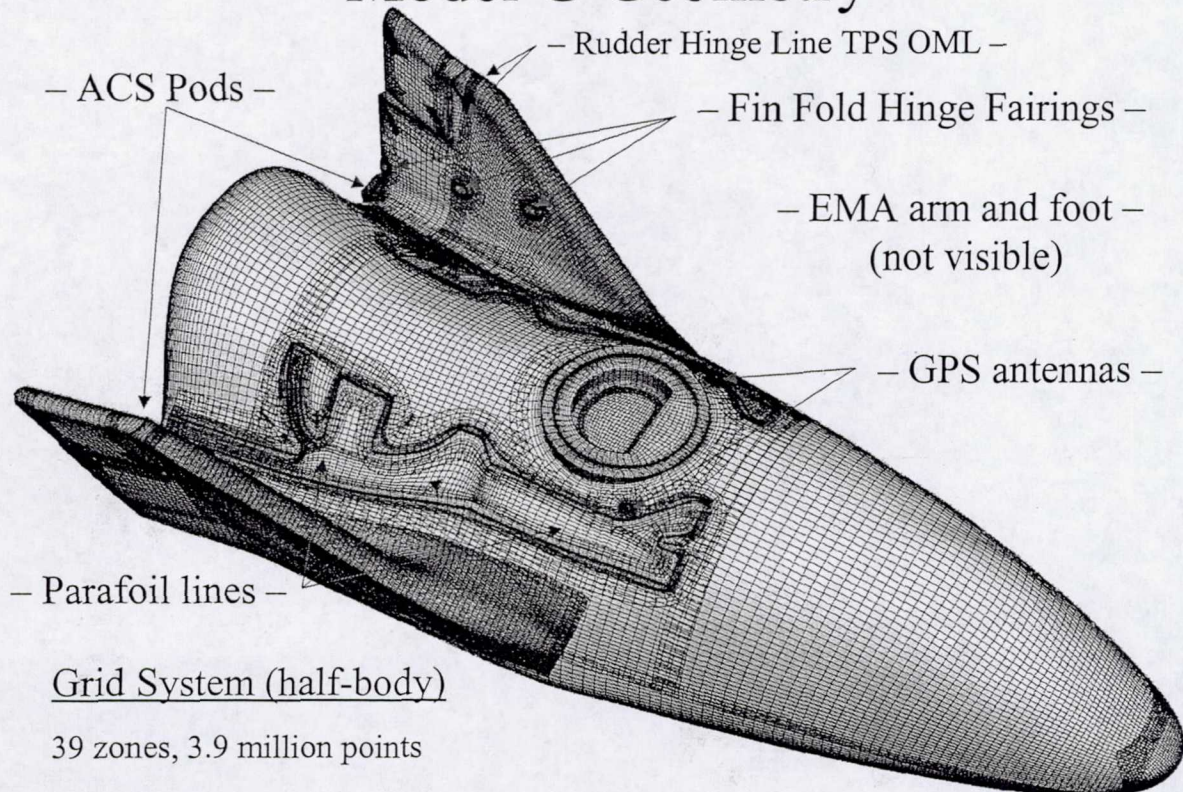
# X-38 Model G

- Background
  - Design evolution → detailed surface geometry
  - Major transonic wind tunnel test (WTT) at the Arnold Engineering and Development Center 16' transonic tunnel (AEDC 16T) in Tullahoma, TN
- CFD Analysis
  - Grids built on same CAD as WT Model
  - Results obtained using OVERFLOW
  - CFD data was compared to AEDC's balance and pressure sensitive paint (PSP) data



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## Model G Geometry

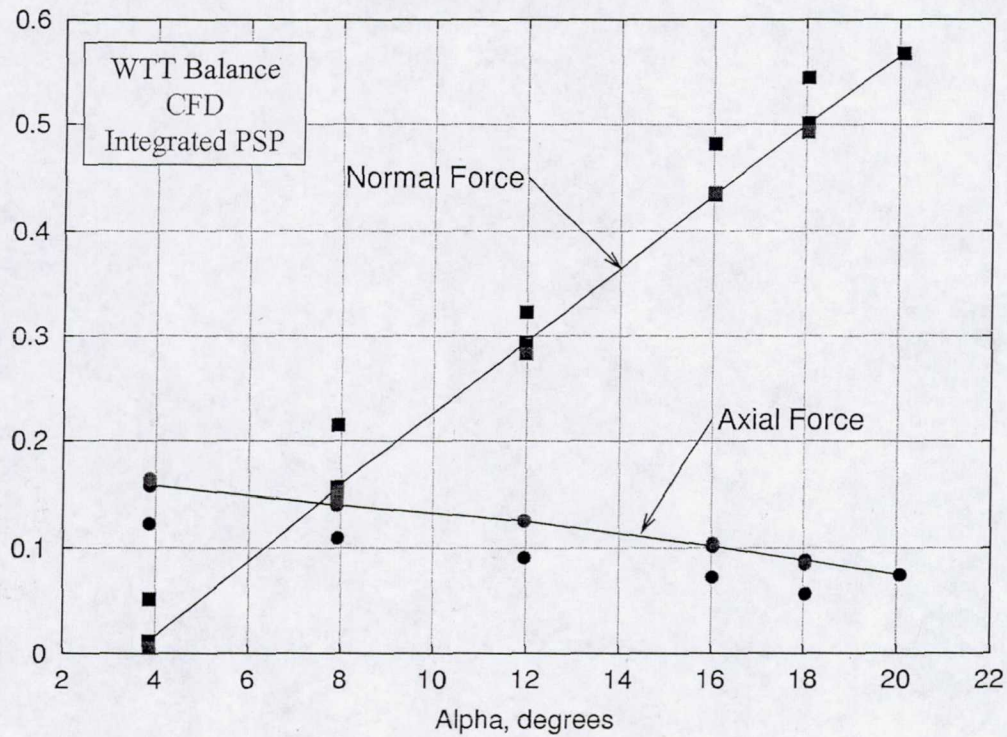


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# AEDC 16T Comparison

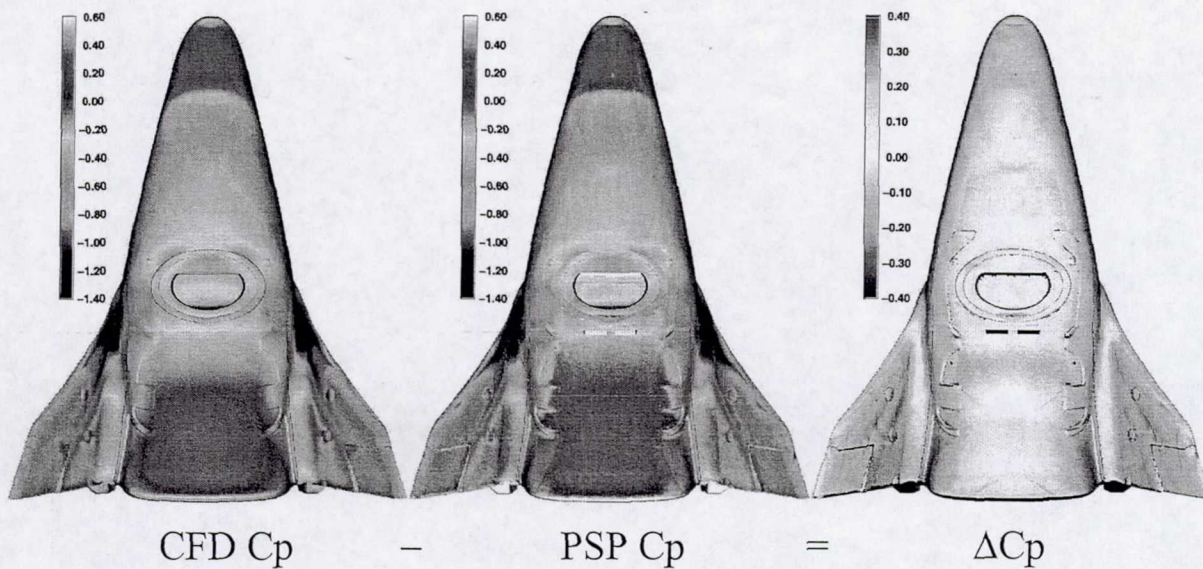
Mach 0.6, Flap = 20°, Rudder = 0°



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## PSP vs. CFD

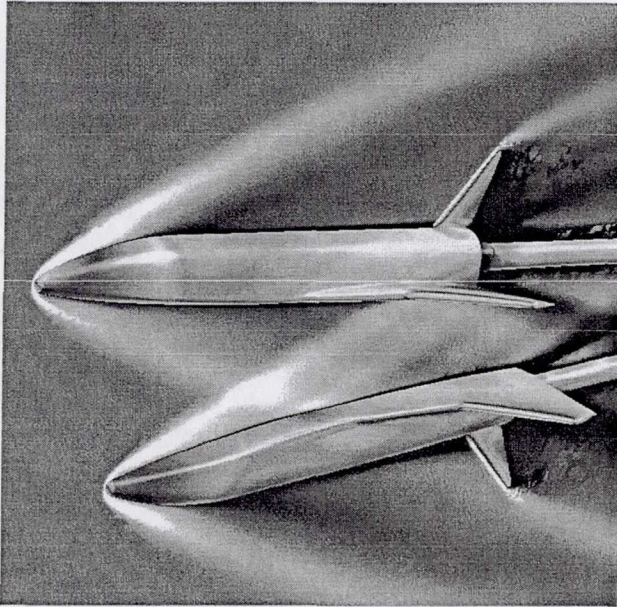
Mach 0.95, Alpha 16°, Beta 0°, Flap 20°, Rudder 0°



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# MSFC ARF Wind Tunnel Simulations



Flow Solver: OVERFLOW  
Freestream: Mach 2.99,  $\alpha = 0^\circ$   
Booster:  $\delta \alpha = 5.123^\circ$   
 $\delta x = 0.2/L_{ref}$   
 $\delta z = 0.15/L_{ref}$   
Log(pressure) on surface  
Log(density) in symmetry plane

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## Future Plans

- Multiple body simulations
  - Both static and dynamic (OVERFLOW 2.0)
  - Requires good geometry definition, automated control surface movement, scripting, etc.
    - Currently working on automated control surface movements for shuttle
- Addition of chemistry to OVERFLOW
  - Have added equilibrium air to OVERFLOW
  - In the process of validating (shuttle, HALIS test case)

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